

The Files

31 March 1959

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Trip Report - IRE National Convention, New York

1. On 24 and 25 March 1959 the writer attended the IRE National Convention in the New York Coliseum, New York. Parts of three technical paper sessions were attended and several manufacturers were asked about their capabilities in fields pertaining to our requirements.

2. **ANTENNAS** - Several interesting developments in the field of antennas were seen. Mr. John H. Dunlavy, Jr., Vice President of All Products Corporation, Mineral Wells, Texas, was asked about his company's interest in log periodic structures. His company is currently making a log periodic antenna covering the range of 30 to 180 mc, type CUV-2A/1-LPA-390. This antenna was made for NSA a short time ago. VSWR is stated to be less than 2 to 1 over the entire operating range. Mr. Dunlavy stated that they had obtained a Collins log periodic antenna a short time ago and that the results of their evaluations indicated that the antenna could not approach the specifications as stated by Collins Radio. It was claimed that at certain frequencies beam splitting occurred which rendered the antenna almost useless. Mr. Dunlavy believes that this is due to the existence of two separate and distinct phase centers at certain frequencies. In a short time APC will announce a new type of broadband antenna developed in their own facilities. Physically the antenna will consist of a long boom and a set of elements similar to a yagi antenna with the exception that the antenna elements will be alternately offset on the boom and their length will vary similarly to the length variations of a conventional log periodic antenna. Gain over a dipole will not be as high as with a log periodic antenna, although no exact figures were given. Bandwidth will be about 3 to 1 and VSWR is claimed to be below 1.2 to 1 over the operating range. Gain may be increased in the future by using larger values of the parameter (same as in log periodic structures). Present designs use a of 0.8 to 0.9. APC also issued a company confidential report covering the design of a rhombic antenna for operation over the range of 4 to 16 mc which is within 1 db of the optimum alignment over the frequency range, contrasted with some commercial rhombic antennas which give very good performance at the lower end of their range and poor performance at the high end of the range. The majority of the research in the antenna study was performed at the University of Texas.

3. On the morning of 25 March a paper was presented entitled "Strip Transmission Line Corporate Feed Structures for Antenna Arrays", by D. Alstradter and E. O. Houseman, Jr., of Melpar, Inc., Falls Church, Virginia. The feed structure described consisted of a printed circuit power divider which can be built with as many as 512 separate outputs with low loss and reasonable power handling capabilities. The outputs of the feed structure are then used to feed the dipole elements of a multielement array in the proper phase and amplitude. Feed tapers of the cosine, cosine², cosine³, and logarithmic types are available using this power distribution technique.

4. On 25 March a portion of a presentation of a paper entitled "A New Concept in High Frequency Antenna Design", by D. G. Berry of Collins Radio Company was attended. The paper described a wire trapezoidal-tooth logarithmically-periodic structure for use in the various communications bands. With the proper choice of antenna parameters, the beam direction can be made to fall at any vertical angle from 60 degrees down to a few degrees. Gain over an isotropic radiator will be from 8 to 18 db. Some space saving is possible using this type of antenna structure instead of the conventional point-to-point rhombic antenna array.

5. The following list of companies and their principal products will show the wide variety of antennas shown at the convention.

Technical Appliance Corporation, Sherburne, New York:

Circularly polarized antennas with manually positionable mounts, 4, 6, 8, and 10-foot parabolas of the expanded metal type. Expanded aluminum reflectors from 4 to 32 feet in diameter are available.

General Bronze Corporation, Garden City, New York:

New type of scatter communications antenna utilizing two crossed rows of helical antennas on a rotator mount.

Andrew Corporation, Chicago, Illinois:

Stacked and phase arrays of helices for long range satellite and missile tracking applications.

D. S. Kennedy & Company, Cohasset, Massachusetts:

Transportable 40-foot radar antennas featuring high strength, quick take-down, and ease of assembly.

6. MICROWAVE EQUIPMENT - Low-noise high-gain microwave receivers and amplifiers were investigated although there did not seem to be too much available at the convention. Menlo Park Engineering of Menlo Park, California, makes a travelling wave tube amplifier covering 12 to 16 kmc, priced at \$3500.00. Gain is 30 db with a maximum noise figure of 25 db; output power is 10 mw minimum, weight is 28 pounds, and power input is 110 volts. Delivery time is 8 to 10 weeks. ITT Labs had a

variable reactance amplifier on display. Frequency of operation is about 800 mc and the noise figure is 1 to 2 db. The entire unit is rack-mounted and about 10 inches high. Menlo Park Engineering, Menlo Park, California, has a complete line of travelling wave tube amplifiers covering from 0.5 to 18 kmc with gains on the order of 25 to 30 db and noise figures of from 10 to 30 db. Power output is from more than 1 db to about 30 dbm max for various models. This company also has a line of backward wave oscillators covering the range of 2 to 18 kmc with power outputs from 5 to 10 milliwatts.

7. Presentations of papers covering microwave tubes were attended on 24 March. A paper entitled "Microwave Detection with Vacuum Tube Diodes" by Dye, Hessler, Knight, Miesch, and Papp, all of ITT Labs, indicated that although detection of microwave signals with vacuum tube diodes is possible in theory, experimental results produced detected outputs from 10 to 100 times smaller than that expected. The main problem seemed to be the lowering of the microwave cavity Q by the insertion of the diode in the cavity.

8. A paper titled "Priming Techniques for Reducing Pulse Jitter on Pulsed Reflex Klystrons" by Paul A. Grandell of the National Company showed that front edge pulse jitter in a pulsed klystron can be materially reduced by inserting a signal into the klystron such that the klystron is held just below oscillation. Upon the application of the pulse signal and the transition from the non-oscillatory to the oscillatory condition is then made much more smoothly due to the perturbations of the electric field in the klystron cavity caused by the inserted signal, causing oscillations to build up much more rapidly.

9. Charles W. Flynn of ITT Labs presented a paper titled "A Multiple Frequency Local Oscillator." Oscillator outputs at several frequencies were obtained by amplitude or phase modulation of a travelling wave tube in such a manner that sum and difference frequencies were generated in the output. As many as 10 separate output frequencies of an amplitude sufficient for local oscillator use were generated in this manner. This approach could be used to generate the local oscillator frequencies for scanning a band of microwave frequencies which has been broken into several sub-bands. Such an approach could use superhetrodyne techniques with the advantage that any signal within a certain range of any one of the local oscillator frequencies would pass into the intermediate frequency amplifiers of the receiver.

10. A paper entitled "Selective Signal Suppression and Limiting in Travelling-Wave Tube Amplifiers" by Wolkstein and Kinaman of RCA indicated that even though the travelling wave tube amplifier is being blocked by the application of a very strong signal, considerable amplification of a weak signal considerably removed from the strong signal can take place. It was suggested that filters can be added to the outside of the TWT to suppress the strong signal sufficiently to allow reasonable amplification of the weak signal.

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11. A paper titled "A New Backward Wave Oscillator for the 4 to 5 mc Region" by Noland and Cohen of Sylvania described the operation and construction of a BWO covering the range of 60 to 75 kmc. The tube has a minimum power output of 1 mw and requires a 1200 gauss focussing field. The tube is voltage tunable and requires a maximum beam voltage of about 1900 volts.

12. On 25 March a paper entitled "Special Consideration in the Design of a Tunable Multi-Element Waveguide Filter" by Robert L. Slever, Airborne Instruments Labs, was presented. The filter used two cavities which were tuned with contacting plungers. Total in-band attenuation was less than 3 db and bandwidth was about 18%. The main problem involved in the tuning of the filter is the mechanical accuracy with which the plungers must be positioned. An error of 0.001 inch can produce an additional in-band attenuation of about 2 db for the first cavity and about 5 db for the second cavity. This filter could solve some of our more critical microwave filter problems where low in-band attenuation is needed and good skirt selectivity is required. Because of the sensitivity of the mechanical adjustments, the filter is probably best suited to preset and locked operation.

13. A paper entitled "Low-Loss S-Band and L-Band Circulators for Use with Masers and Reactance Amplifiers" by Arams, Krayner, and Okwit, Airborne Instruments Labs, was presented on 25 March. Bandwidths of 11% in the S-Band and 18 in the L-Band are obtainable with an insertion loss of not more than 0.3 db and a noise figure of about 1 db. The circulator uses a ferrite slab as the phase shifting element and requires good isolation (better than 30 db) and excellent impedance matching of all terminations for good low noise operation. One approach to low noise operation is to detune the input to the receiver so that noise signals from the circulator to the receiver and back again are attenuated twice while the desired signals are only attenuated once in passage to the receiver. Refrigeration of the matched load opposite the reactance amplifier will reduce the noise figure considerably.

14. VACUUM TUBES - In the field of new vacuum tubes both the Tung Sol cold cathode tube and the RCA Muvistor were investigated. Inquiries for information about the cold cathode tube yielded no results and I was told that the information about current developments was classified and that they could not talk about it. Several RCA Muvistors were operating, one in a liquid gas at a temperature of -195°C and one at a temperature of +350°C. No information was available but

15. DATA REDUCTION - In the field of automatic data reduction (R&D Project 2662) several company representatives were asked about their capabilities in the data reduction field.

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16. Thompson Ramo-Wooldridge Corporation of Los Angeles has a digital control computer, type RW-300, priced at \$100,000. A companion unit tape transport and analog-digital conversion unit is available. Mr. Rigdon Currie of RW surmises that a total price of \$250,000 would probably buy a complete input conversion system, the RW-300 computer, and the suitable readout device for the presentation of the data. The RW computer has drum storage, up to 500 analog and digital inputs, and provisions for either printed output or punched paper tape input and output. The computer as it stands will not solve our data reduction problems but with the proper input devices it could provide an interim solution to the problem.

17. MAGNETIC MEMORIES - Several companies were contacted on the problem of building a small magnetic memory (Project 2158). They were approached with the following problem. Design a magnetic memory which is as small as possible and will store a minimum of 250 words of 5 to 10 bits in length each. Read-in and read-out will be serial with destructive read-out. High frequency techniques are not needed since the pulse repetition frequency will be quite low. No special provisions for cooling, such as blowers, will be allowed.

19. Mr. Nathan O. Sokal of Bi/An Controls, Inc., was contacted about the problem. They will send information on the various types of magnetic memories which they have, although it does not seem that they have the capabilities to solve our problem. General Mills of Minneapolis, Minnesota, although a relative newcomer to the field of magnetic memories, stated that they would definitely be interested in the construction of such a device and will send some information as to their facilities for undertaking such work.

20. Several miscellaneous items of general interest were obtained. The Bristol Company of Waterbury, Connecticut, makes a high frequency chopper operating at about 1500 cps. A chopper at a

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frequency only a little higher than this could be used to quantize slowly varying alternating signal information as the first step toward cryptographic encipherment of the signal. Such a method would have the advantage of great simplicity, and maintenance consisting of periodic replacement of the chopper unit.

21. Telex of St. Paul, Minnesota, has announced a "Mini-Mike" model 100 speaker microphone only 1 x 1 x 3/4 inches in size. Nominal frequency response is to about 3500 cycles, impedance is 10 ohms, microphone sensitivity is 52 db below 1 volt per dyne per sq. centimeter of sound pressure with a matching transformer, and speaker output is 124 db with 10 milliwatts of power input. Such a speaker could be used in miniature portable radio receivers where use of headphones is not required for noise suppression purposes.

22. Borg-Warner Electronics in Santa Ana, California, has announced a miniature magnetic tape recorder model MR-11B for data recording. The unit uses 2 tapes and is capable of recording 16 tracks of information at the same time. Size of the recorder is 7-1/2 x 3-9/16 diameter. Tape speed is 3-3/4 ips for 120 seconds record time and response to 250 cps. Speeds are available up to 15 ips with response to 1000 cps and recording time of 1/2 minute. Batteries are self-contained and total weight is 3.8 pounds without case and 6 pounds with case. Properly adapted, the unit could be used for voice recording for extended periods of time. The unit was originally intended for use in guided missiles for short term recording of telemetry data.

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